

§ 250.417

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in the wellbore; and all other information required by the District Supervisor in the interests of resource evaluation, waste prevention, conservation of natural resources, protection of correlative rights, safety, and environment.

(b) When drilling operations are suspended, or temporarily prohibited under the provisions of § 250.170 of this part, the lessee shall, within 30 days after termination of the suspension or temporary prohibition or within 30 days after the completion of any activities related to the suspension or prohibition, transmit to the District Supervisor duplicate copies of the records of all activities related to and conducted during the suspension or temporary prohibition on, or attached to, Form MMS-125, Well Summary Report, or Form MMS-124, as appropriate.

(c) Upon request by the Regional or District Supervisor, the lessee shall furnish the following:

(1) Copies of the records of any of the well operations specified in paragraph (a) of this section;

(2) Paleontological reports identifying microscopic fossils by depth and/or washed samples of drill cuttings normally maintained by the lessee for paleontological determinations;

(3) Copies of the daily driller's report at a frequency as determined by the District Supervisor. Items to be reported include spud dates, casing setting depths, cement quantities, casing characteristics, pressure integrity tests, mud weights, kicks, lost returns, and any unusual activities; and

(4) Legible, exact copies of service company reports on cementing, perforating, acidizing, analyses of cores, testing, or other similar services.

(d) As soon as available, the lessee shall transmit copies (field or final prints of individual runs) of logs or charts of electrical, radioactive, sonic, and other well-logging operations, directional-well surveys, and analyses of cores. Composite logs of multiple runs and directional-well surveys shall be transmitted to the District Supervisor in duplicate as soon as available but not later than 30 days after completion of each well.

(e) If the drilling unit moves from the wellbore prior to completing the well,

the lessee shall submit to the District Supervisor copies of the well records with completed Form MMS-124, within 30 days after moving from the wellbore.

(f) If the Regional or District Supervisor determines that circumstances warrant, the lessee shall submit any other reports and records of operations, including paleontological interpretations based upon identification of microscopic fossils, in the manner and form prescribed by the Regional or District Supervisor.

(g) Records relating to the drilling of a well shall be retained for a period of 90 days after drilling operations are completed. Records relating to the completion of a well or of any workover activity which materially alters the completion configuration or materially affects or alters a hydrocarbon-bearing zone shall be kept until the well is permanently plugged and abandoned.

[53 FR 10690, Apr. 1, 1988, as amended at 58 FR 49928, Sept. 24, 1993. Redesignated and amended at 63 FR 29479, 29485, May 29, 1998; 64 FR 72794, Dec. 28, 1999]

§ 250.417 Hydrogen sulfide.

(a) *What precautions must I take when operating in an H₂S area?* You must:

(1) Take all necessary and feasible precautions and measures to protect personnel from the toxic effects of H₂S and to mitigate damage to property and the environment caused by H₂S. You must follow the requirements of this section when conducting drilling, well-completion/well-workover, and production operations in zones with H₂S present and when conducting operations in zones where the presence of H₂S is unknown. You do not need to follow these requirements when operating in zones where the absence of H₂S has been confirmed; and

(2) Follow your approved contingency plan.

(b) *Definitions.* Terms used in this section have the following meanings:

Facility means a vessel, a structure, or an artificial island used for drilling, well-completion, well-workover, and/or production operations.

H₂S absent means:

(1) Drilling, logging, coring, testing, or producing operations have confirmed the absence of H₂S in concentrations that could potentially result in atmospheric concentrations of 20 ppm or more of H₂S; or

(2) Drilling in the surrounding areas and correlation of geological and seismic data with equivalent stratigraphic units have confirmed an absence of H₂S throughout the area to be drilled.

H₂S present means that drilling, logging, coring, testing, or producing operations have confirmed the presence of H₂S in concentrations and volumes that could potentially result in atmospheric concentrations of 20 ppm or more of H₂S.

H₂S unknown means the designation of a zone or geologic formation where neither the presence nor absence of H₂S has been confirmed.

Well-control fluid means drilling mud and completion or workover fluid as appropriate to the particular operation being conducted.

(c) *Classifying an area for the presence of H₂S.* You must:

(1) Request and obtain an approved classification for the area from the Regional Supervisor before you begin operations. Classifications are "H₂S absent," "H₂S present," or "H₂S unknown";

(2) Submit your request with your application for permit to drill;

(3) Support your request with available information such as geologic and geophysical data and correlations, well logs, formation tests, cores and analysis of formation fluids; and

(4) Submit a request for reclassification of a zone when additional data indicate a different classification is needed.

(d) *What do I do if conditions change?* If you encounter H₂S that could potentially result in atmospheric concentrations of 20 ppm or more in areas not previously classified as having H₂S present, you must immediately notify MMS and begin to follow requirements for areas with H₂S present.

(e) *What are the requirements for conducting simultaneous operations?* When conducting any combination of drilling, well-completion, well-workover, and production operations simultaneously, you must follow the require-

ments in the section applicable to each individual operation.

(f) *Requirements for submitting an H₂S Contingency Plan.* Before you begin operations, you must submit an H₂S Contingency Plan to the District Supervisor for approval. Do not begin operations before the District Supervisor approves your plan. You must keep a copy of the approved plan in the field, and you must follow the plan at all times. Your plan must include:

(1) Safety procedures and rules that you will follow concerning equipment, drills, and smoking;

(2) Training you provide for employees, contractors, and visitors;

(3) Job position and title of the person responsible for the overall safety of personnel;

(4) Other key positions, how these positions fit into your organization, and what the functions, duties, and responsibilities of those job positions are;

(5) Actions that you will take when the concentration of H₂S in the atmosphere reaches 20 ppm, who will be responsible for those actions, and a description of the audible and visual alarms to be activated;

(6) Briefing areas where personnel will assemble during an H₂S alert. You must have at least two briefing areas on each facility and use the briefing area that is upwind of the H₂S source at any given time;

(7) Criteria you will use to decide when to evacuate the facility and procedures you will use to safely evacuate all personnel from the facility by vessel, capsule, or lifeboat. If you use helicopters during H₂S alerts, describe the types of H₂S emergencies during which you consider the risk of helicopter activity to be acceptable and the precautions you will take during the flights;

(8) Procedures you will use to safely position all vessels attendant to the facility. Indicate where you will locate the vessels with respect to wind direction. Include the distance from the facility and what procedures you will use to safely relocate the vessels in an emergency;

(9) How you will provide protective-breathing equipment for all personnel, including contractors and visitors;

(10) The agencies and facilities you will notify in case of a release of H₂S (that constitutes an emergency), how you will notify them, and their telephone numbers. Include all facilities that might be exposed to atmospheric concentrations of 20 ppm or more of H₂S;

(11) The medical personnel and facilities you will use if needed, their addresses, and telephone numbers;

(12) H₂S detector locations in production facilities producing gas containing 20 ppm or more of H₂S. Include an "H₂S Detector Location Drawing" showing:

(i) All vessels, flare outlets, wellheads, and other equipment handling production containing H₂S;

(ii) Approximate maximum concentration of H₂S in the gas stream; and

(iii) Location of all H₂S sensors included in your contingency plan;

(13) Operational conditions when you expect to flare gas containing H₂S including the estimated maximum gas flow rate, H₂S concentration, and duration of flaring;

(14) Your assessment of the risks to personnel during flaring and what precautionary measures you will take;

(15) Primary and alternate methods to ignite the flare and procedures for sustaining ignition and monitoring the status of the flare (i.e., ignited or extinguished);

(16) Procedures to shut off the gas to the flare in the event the flare is extinguished;

(17) Portable or fixed sulphur dioxide (SO₂)-detection system(s) you will use to determine SO₂ concentration and exposure hazard when H₂S is burned;

(18) Increased monitoring and warning procedures you will take when the SO₂ concentration in the atmosphere reaches 2 ppm;

(19) Personnel protection measures or evacuation procedures you will initiate when the SO₂ concentration in the atmosphere reaches 5 ppm;

(20) Engineering controls to protect personnel from SO₂; and

(21) Any special equipment, procedures, or precautions you will use if you conduct any combination of drilling, well-completion, well-workover, and production operations simultaneously.

(g) *Training program.*

(1) *When and how often do employees need to be trained?* All operators and contract personnel must complete an H₂S training program to meet the requirements of this section:

(i) Before beginning work at the facility; and

(ii) Each year, within 1 year after completion of the previous class.

(2) *What training documentation do I need?* For each individual working on the platform, either:

(i) You must have documentation of this training at the facility where the individual is employed; or

(ii) The employee must carry a training completion card.

(3) *What training do I need to give to visitors and employees previously trained on another facility?*

(i) Trained employees or contractors transferred from another facility must attend a supplemental briefing on your H₂S equipment and procedures before beginning duty at your facility;

(ii) Visitors who will remain on your facility more than 24 hours must receive the training required for employees by paragraph (g)(4) of this section; and

(iii) Visitors who will depart before spending 24 hours on the facility are exempt from the training required for employees, but they must, upon arrival, complete a briefing that includes:

(A) Information on the location and use of an assigned respirator; practice in donning and adjusting the assigned respirator; information on the safe briefing areas, alarm system, and hazards of H₂S and SO₂; and

(B) Instructions on their responsibilities in the event of an H₂S release.

(4) *What training must I provide to all other employees?* You must train all individuals on your facility on the:

(i) Hazards of H₂S and of SO₂ and the provisions for personnel safety contained in the H₂S Contingency Plan;

(ii) Proper use of safety equipment which the employee may be required to use;

(iii) Location of protective breathing equipment, H₂S detectors and alarms, ventilation equipment, briefing areas,

warning systems, evacuation procedures, and the direction of prevailing winds;

(iv) Restrictions and corrective measures concerning beards, spectacles, and contact lenses in conformance with ANSI Z88.2;

(v) Basic first-aid procedures applicable to victims of H₂S exposure. During all drills and training sessions, you must address procedures for rescue and first aid for H₂S victims;

(vi) Location of:

(A) The first-aid kit on the facility;

(B) Resuscitators; and

(C) Litter or other device on the facility.

(vii) Meaning of all warning signals.

(5) *Do I need to post safety information?* You must prominently post safety information on the facility and on vessels serving the facility (i.e., basic first-aid, escape routes, instructions for use of life boats, etc.).

(h) *Drills. (1) When and how often do I need to conduct drills on H₂S safety discussions on the facility?* You must:

(i) Conduct a drill for each person at the facility during normal duty hours at least once every 7-day period. The drills must consist of a dry-run performance of personnel activities related to assigned jobs.

(ii) At a safety meeting or other meetings of all personnel, discuss drill performance, new H₂S considerations at the facility, and other updated H₂S information at least monthly.

(2) *What documentation do I need?* You must keep records of attendance for:

(i) Drilling, well-completion, and well-workover operations at the facility until operations are completed; and

(ii) Production operations at the facility or at the nearest field office for 1 year.

(i) *Visual and audible warning systems—(1) How must I install wind direction equipment?* You must install wind-direction equipment in a location visible at all times to individuals on or in the immediate vicinity of the facility.

(2) *When do I need to display operational danger signs, display flags, or activate visual or audible alarms?*

(i) You must display warning signs at all times on facilities with wells capable of producing H₂S and on facilities

that process gas containing H₂S in concentrations of 20 ppm or more.

(ii) In addition to the signs, you must activate audible alarms and display flags or activate flashing red lights when atmospheric concentration of H₂S reaches 20 ppm.

(3) *What are the requirements for signs?* Each sign must be a high-visibility yellow color with black lettering as follows:

Letter height	Wording
12 inches	Danger. Poisonous Gas. Hydrogen Sulfide.
7 inches	Do not approach if red flag is flying. Do not approach if red lights are flashing.
(Use appropriate wording at right).	

(4) *May I use existing signs?* You may use existing signs containing the words "Danger-Hydrogen Sulfide-H₂S," provided the words "Poisonous Gas. Do Not Approach if Red Flag is Flying" or "Red Lights are Flashing" in lettering of a minimum of 7 inches in height are displayed on a sign immediately adjacent to the existing sign.

(5) *What are the requirements for flashing lights or flags?* You must activate a sufficient number of lights or hoist a sufficient number of flags to be visible to vessels and aircraft. Each light must be of sufficient intensity to be seen by approaching vessels or aircraft any time it is activated (day or night). Each flag must be red, rectangular, a minimum width of 3 feet, and a minimum height of 2 feet.

(6) *What is an audible warning system?* An audible warning system is a public address system or siren, horn, or other similar warning device with a unique sound used only for H₂S.

(7) *Are there any other requirements for visual or audible warning devices?* Yes, you must:

(i) Illuminate all signs and flags at night and under conditions of poor visibility; and

(ii) Use warning devices that are suitable for the electrical classification of the area.

(8) *What actions must I take when the alarms are activated?* When the warning devices are activated, the designated responsible persons must inform personnel of the level of danger and issue

instructions on the initiation of appropriate protective measures.

(j) *H₂S-detection and H₂S monitoring equipment*—(1) *What are the requirements for an H₂S detection system?* An H₂S detection system must:

(i) Be capable of sensing a minimum of 10 ppm of H₂S in the atmosphere; and

(ii) Activate audible and visual alarms when the concentration of H₂S in the atmosphere reaches 20 ppm.

(2) *Where must I have sensors for drilling, well-completion, and well-workover operations?* You must locate sensors at the:

- (i) Bell nipple;
- (ii) Mud-return line receiver tank (possum belly);
- (iii) Pipe-trip tank;
- (iv) Shale shaker;
- (v) Well-control fluid pit area;
- (vi) Driller's station;
- (vii) Living quarters; and
- (viii) All other areas where H₂S may accumulate.

(3) *Do I need mud sensors?* The District Supervisor may require mud sensors in the possum belly in cases where the ambient air sensors in the mud-return system do not consistently detect the presence of H₂S.

(4) *How often must I observe the sensors?* During drilling, well-completion and well-workover operations, you must continuously observe the H₂S levels indicated by the monitors in the work areas during the following operations:

- (i) When you pull a wet string of drill pipe or workover string;
- (ii) When circulating bottoms-up after a drilling break;
- (iii) During cementing operations;
- (iv) During logging operations; and
- (v) When circulating to condition mud or other well-control fluid.

(5) *Where must I have sensors for production operations?* On a platform where gas containing H₂S of 20 ppm or greater is produced, processed, or otherwise handled:

(i) You must have a sensor in rooms, buildings, deck areas, or low-laying deck areas not otherwise covered by paragraph (j)(2) of this section, where atmospheric concentrations of H₂S could reach 20 ppm or more. You must have at least one sensor per 400 square

feet of deck area or fractional part of 400 square feet;

(ii) You must have a sensor in buildings where personnel have their living quarters;

(iii) You must have a sensor within 10 feet of each vessel, compressor, well-head, manifold, or pump, which could release enough H₂S to result in atmospheric concentrations of 20 ppm at a distance of 10 feet from the component;

(iv) You may use one sensor to detect H₂S around multiple pieces of equipment, provided the sensor is located no more than 10 feet from each piece, except that you need to use at least two sensors to monitor compressors exceeding 50 horsepower;

(v) You do not need to have sensors near wells that are shut in at the master valve and sealed closed;

(vi) When you determine where to place sensors, you must consider:

(A) The location of system fittings, flanges, valves, and other devices subject to leaks to the atmosphere; and

(B) Design factors, such as the type of decking and the location of fire walls; and

(vii) The District Supervisor may require additional sensors or other monitoring capabilities, if warranted by site specific conditions.

(6) *How must I functionally test the H₂S Detectors?*

(i) Personnel trained to calibrate the particular H₂S detector equipment being used must test detectors by exposing them to a known concentration in the range of 10 to 30 ppm of H₂S.

(ii) If the results of any functional test are not within 2 ppm or 10 percent, whichever is greater, of the applied concentration, recalibrate the instrument.

(7) *How often must I test my detectors?*

(i) When conducting drilling, drill stem testing, well-completion, or well-workover operations in areas classified as H₂S present or H₂S unknown, test all detectors at least once every 24 hours. When drilling, begin functional testing before the bit is 1,500 feet (vertically) above the potential H₂S zone.

(ii) When conducting production operations, test all detectors at least every 14 days between tests.

(iii) If equipment requires calibration as a result of two consecutive functional tests, the District Supervisor may require that H₂S-detection and H₂S-monitoring equipment be functionally tested and calibrated more frequently.

(8) *What documentation must I keep?*

(i) You must maintain records of testing and calibrations (in the drilling or production operations report, as applicable) at the facility to show the present status and history of each device, including dates and details concerning:

- (A) Installation;
- (B) Removal;
- (C) Inspection;
- (D) Repairs;
- (E) Adjustments; and
- (F) Reinstallation.

(ii) Records must be available for inspection by MMS personnel.

(9) *What are the requirements for nearby vessels?* If vessels are stationed overnight alongside facilities in areas of H₂S present or H₂S unknown, you must equip vessels with an H₂S-detection system that activates audible and visual alarms when the concentration of H₂S in the atmosphere reaches 20 ppm. This requirement does not apply to vessels positioned upwind and at a safe distance from the facility in accordance with the positioning procedure described in the approved H₂S Contingency Plan.

(10) *What are the requirements for nearby facilities?* The District Supervisor may require you to equip nearby facilities with portable or fixed H₂S detector(s) and to test and calibrate those detectors. To invoke this requirement, the District Supervisor will consider dispersion modeling results from a possible release to determine if 20 ppm H₂S concentration levels could be exceeded at nearby facilities.

(11) *What must I do to protect against SO₂ if I burn gas containing H₂S?* You must:

(i) Monitor the SO₂ concentration in the air with portable or strategically placed fixed devices capable of detecting a minimum of 2 ppm of SO₂;

(ii) Take readings at least hourly and at any time personnel detect SO₂ odor or nasal irritation;

(iii) Implement the personnel protective measures specified in the H₂S Contingency Plan if the SO₂ concentration in the work area reaches 2 ppm; and

(iv) Calibrate devices every 3 months if you use fixed or portable electronic sensing devices to detect SO₂.

(12) *May I use alternative measures?*

You may follow alternative measures instead of those in paragraph (j)(11) of this section if you propose and the Regional Supervisor approves the alternative measures.

(13) *What are the requirements for protective-breathing equipment?* In an area classified as H₂S present or H₂S unknown, you must:

(i) Provide all personnel, including contractors and visitors on a facility, with immediate access to self-contained pressure-demand-type respirators with hose-line capability and breathing time of at least 15 minutes.

(ii) Design, select, use, and maintain respirators to conform to ANSI Z88.2, American National Standard for Respiratory Protection.

(iii) Make available at least two voice-transmission devices, which can be used while wearing a respirator, for use by designated personnel.

(iv) Make spectacle kits available as needed.

(v) Store protective-breathing equipment in a location that is quickly and easily accessible to all personnel.

(vi) Label all breathing-air bottles as containing breathing-quality air for human use.

(vii) Ensure that vessels attendant to facilities carry appropriate protective-breathing equipment for each crew member. The District Supervisor may require additional protective-breathing equipment on certain vessels attendant to the facility.

(viii) During H₂S alerts, limit helicopter flights to and from facilities to the conditions specified in the H₂S Contingency Plan. During authorized flights, the flight crew and passengers must use pressure-demand-type respirators. You must train all members of flight crews in the use of the particular type(s) of respirator equipment made available.

(ix) As appropriate to the particular operation(s), (production, drilling,

well-completion or well-workover operations, or any combination of them), provide a system of breathing-air manifolds, hoses, and masks at the facility and the briefing areas. You must provide a cascade air-bottle system for the breathing-air manifolds to refill individual protective-breathing apparatus bottles. The cascade air-bottle system may be recharged by a high-pressure compressor suitable for providing breathing-quality air, provided the compressor suction is located in an uncontaminated atmosphere.

(k) *Personnel safety equipment—(1) What additional personnel-safety equipment do I need?* You must ensure that your facility has:

(i) Portable H₂S detectors capable of detecting a 10 ppm concentration of H₂S in the air available for use by all personnel;

(ii) Retrieval ropes with safety harnesses to retrieve incapacitated personnel from contaminated areas;

(iii) Chalkboards and/or note pads for communication purposes located on the rig floor, shale-shaker area, the cement-pump rooms, well-bay areas, production processing equipment area, gas compressor area, and pipeline-pump area;

(iv) Bull horns and flashing lights; and

(v) At least three resuscitators on manned facilities, and a number equal to the personnel on board, not to exceed three, on normally unmanned facilities, complete with face masks, oxygen bottles, and spare oxygen bottles.

(2) *What are the requirements for ventilation equipment?* You must:

(i) Use only explosion-proof ventilation devices;

(ii) Install ventilation devices in areas where H₂S or SO₂ may accumulate; and

(iii) Provide movable ventilation devices in work areas. The movable ventilation devices must be multidirectional and capable of dispersing H₂S or SO₂ vapors away from working personnel.

(3) *What other personnel safety equipment do I need?* You must have the following equipment readily available on each facility:

(i) A first-aid kit of appropriate size and content for the number of personnel on the facility; and

(ii) At least one litter or an equivalent device.

(l) *Do I need to notify MMS in the event of an H₂S release?* You must notify MMS without delay in the event of a gas release which results in a 15-minute time weighted average atmospheric concentration of H₂S of 20 ppm or more anywhere on the facility.

(m) *Do I need to use special drilling, completion and workover fluids or procedures?* When working in an area classified as H₂S present or H₂S unknown:

(1) You may use either water- or oil-base muds in accordance with § 250.300(b)(1).

(2) If you use water-base well-control fluids, and if ambient air sensors detect H₂S, you must immediately conduct either the Garrett-Gas-Train test or a comparable test for soluble sulfides to confirm the presence of H₂S.

(3) If the concentration detected by air sensors is over 20 ppm, personnel conducting the tests must don protective-breathing equipment conforming to paragraph (j)(13) of this section.

(4) You must maintain on the facility sufficient quantities of additives for the control of H₂S, well-control fluid pH, and corrosion equipment.

(i) *Scavengers.* You must have scavengers for control of H₂S available on the facility. When H₂S is detected, you must add scavengers as needed. You must suspend drilling until the scavenger is circulated throughout the system.

(ii) *Control pH.* You must add additives for the control of pH to water-base well-control fluids in sufficient quantities to maintain pH of at least 10.0.

(iii) *Corrosion inhibitors.* You must add additives to the well-control fluid system as needed for the control of corrosion.

(5) You must degas well-control fluids containing H₂S at the optimum location for the particular facility. You must collect the gases removed and burn them in a closed flare system conforming to paragraph (q)(6) of this section.

(n) *What must I do in the event of a kick?* In the event of a kick, you must

use one of the following alternatives to dispose of the well-influx fluids giving consideration to personnel safety, possible environmental damage, and possible facility well-equipment damage:

(1) Contain the well-fluid influx by shutting in the well and pumping the fluids back into the formation.

(2) Control the kick by using appropriate well-control techniques to prevent formation fracturing in an open hole within the pressure limits of the well equipment (drill pipe, work string, casing, wellhead, BOP system, and related equipment). The disposal of H₂S and other gases must be through pressurized or atmospheric mud-separator equipment depending on volume, pressure and concentration of H₂S. The equipment must be designed to recover well-control fluids and burn the gases separated from the well-control fluid. The well-control fluid must be treated to neutralize H₂S and restore and maintain the proper quality.

(o) *Well testing in a zone known to contain H₂S.* When testing a well in a zone with H₂S present, you must do all of the following:

(1) Before starting a well test, conduct safety meetings for all personnel who will be on the facility during the test. At the meetings, emphasize the use of protective-breathing equipment, first-aid procedures, and the Contingency Plan. Only competent personnel who are trained and are knowledgeable of the hazardous effects of H₂S must be engaged in these tests.

(2) Perform well testing with the minimum number of personnel in the immediate vicinity of the rig floor and with the appropriate test equipment to safely and adequately perform the test. During the test, you must continuously monitor H₂S levels.

(3) Not burn produced gases except through a flare which meets the requirements of paragraph (q)(6) of this section. Before flaring gas containing H₂S, you must activate SO₂ monitoring equipment in accordance with paragraph (j)(11) of this section. If you detect SO₂ in excess of 2 ppm, you must implement the personnel protective measures in your H₂S Contingency Plan, required by paragraph (f)(13)(iv) of this section. You must also follow the requirements of § 250.1105. You

must pipe gases from stored test fluids into the flare outlet and burn them.

(4) Use downhole test tools and wellhead equipment suitable for H₂S service.

(5) Use tubulars suitable for H₂S service. You must not use drill pipe for well testing without the prior approval of the District Supervisor. Water cushions must be thoroughly inhibited in order to prevent H₂S attack on metals. You must flush the test string fluid treated for this purpose after completion of the test.

(6) Use surface test units and related equipment that is designed for H₂S service.

(p) *Metallurgical properties of equipment.* When operating in a zone with H₂S present, you must use equipment that is constructed of materials with metallurgical properties that resist or prevent sulfide stress cracking (also known as hydrogen embrittlement, stress corrosion cracking, or H₂S embrittlement), chloride-stress cracking, hydrogen-induced cracking, and other failure modes. You must do all of the following:

(1) Use tubulars and other equipment, casing, tubing, drill pipe, couplings, flanges, and related equipment that is designed for H₂S service.

(2) Use BOP system components, wellhead, pressure-control equipment, and related equipment exposed to H₂S-bearing fluids that conform to NACE Standard MR0175-99.

(3) Use temporary downhole well-security devices such as retrievable packers and bridge plugs that are designed for H₂S service.

(4) When producing in zones bearing H₂S, use equipment constructed of materials capable of resisting or preventing sulfide stress cracking.

(5) Keep the use of welding to a minimum during the installation or modification of a production facility. Welding must be done in a manner that ensures resistance to sulfide stress cracking.

(q) *General requirements when operating in an H₂S zone—(1) Coring operations.* When you conduct coring operations in H₂S-bearing zones, all personnel in the working area must wear protective-breathing equipment at least 10 stands in advance of retrieving

the core barrel. Cores to be transported must be sealed and marked for the presence of H₂S.

(2) *Logging operations.* You must treat and condition well-control fluid in use for logging operations to minimize the effects of H₂S on the logging equipment.

(3) *Stripping operations.* Personnel must monitor displaced well-control fluid returns and wear protective-breathing equipment in the working area when the atmospheric concentration of H₂S reaches 20 ppm or if the well is under pressure.

(4) *Gas-cut well-control fluid or well kick from H₂S-bearing zone.* If you decide to circulate out a kick, personnel in the working area during bottoms-up and extended-kill operations must wear protective-breathing equipment.

(5) *Drill- and workover-string design and precautions.* Drill- and workover-strings must be designed consistent with the anticipated depth, conditions of the hole, and reservoir environment to be encountered. You must minimize exposure of the drill- or workover-string to high stresses as much as practical and consistent with well conditions. Proper handling techniques must be taken to minimize notching and stress concentrations. Precautions must be taken to minimize stresses caused by doglegs, improper stiffness ratios, improper torque, whip, abrasive wear on tool joints, and joint imbalance.

(6) *Flare system.* The flare outlet must be of a diameter that allows easy non-restricted flow of gas. You must locate flare line outlets on the downside of the facility and as far from the facility as is feasible, taking into account the prevailing wind directions, the wake effects caused by the facility and adjacent structure(s), and the height of all such facilities and structures. You must equip the flare outlet with an automatic ignition system including a pilot-light gas source or an equivalent system. You must have alternate methods for igniting the flare. You must pipe to the flare system used for H₂S all vents from production process equipment, tanks, relief valves, burst plates, and similar devices.

(7) *Corrosion mitigation.* You must use effective means of monitoring and con-

trolling corrosion caused by acid gases (H₂S and CO₂) in both the downhole and surface portions of a production system. You must take specific corrosion monitoring and mitigating measures in areas of unusually severe corrosion where accumulation of water and/or higher concentration of H₂S exists.

(8) *Wireline lubricators.* Lubricators which may be exposed to fluids containing H₂S must be of H₂S-resistant materials.

(9) *Fuel and/or instrument gas.* You must not use gas containing H₂S for instrument gas. You must not use gas containing H₂S for fuel gas without the prior approval of the District Supervisor.

(10) *Sensing lines and devices.* Metals used for sensing line and safety-control devices which are necessarily exposed to H₂S-bearing fluids must be constructed of H₂S-corrosion resistant materials or coated so as to resist H₂S corrosion.

(11) *Elastomer seals.* You must use H₂S-resistant materials for all seals which may be exposed to fluids containing H₂S.

(12) *Water disposal.* If you dispose of produced water by means other than subsurface injection, you must submit to the District Supervisor an analysis of the anticipated H₂S content of the water at the final treatment vessel and at the discharge point. The District Supervisor may require that the water be treated for removal of H₂S. The District Supervisor may require the submittal of an updated analysis if the water disposal rate or the potential H₂S content increases.

(13) *Deck drains.* You must equip open deck drains with traps or similar devices to prevent the escape of H₂S gas into the atmosphere.

(14) *Sealed voids.* You must take precautions to eliminate sealed spaces in piping designs (e.g., slip-on flanges, reinforcing pads) which can be invaded by atomic hydrogen when H₂S is present.

[62 FR 3795, Jan. 27, 1997. Redesignated and amended at 63 FR 29479, 29485, May 29, 1998; 65 FR 15864, Mar. 24, 2000]